THE AVIATION WORKING GROUP #1

Moderator Dr. Barry Strauch, National Transportation Safety Board
Analyst Dr. Ben Berman, National Transportation Safety Board

Technical Representatives
Mr. Bob MacIntosh, National Transportation Safety Board
Mr. David Schroeder, Federal Aviation Administration

Hours of Service and Scheduling

The group expressed the view that, because of the criticality of scheduling on human fatigue and alertness, that duty time limits should be upgraded for flightcrew members and established for flight attendants, as well as address issues of circadian rhythms and human performance. All proposed rule changes should be based on the results of scientifically sound sleep research. In addition, it was suggested that rules be promulgated to establish controlled rest during long-haul flight operations.

Nevertheless, concerns were raised that revised flight and duty time rules not be so rigid as to create their own safety hazards. For example, an issue in the Tenerife ground collision between KLM and Pan American Boeing 747s was the inflexible flight and duty time restriction the KLM flightcrew faced at the end of the scheduled flight to Amsterdam. One suggestion was to pattern rules after the advanced qualification program (AQP), which provide airlines considerable flexibility to tailor pilot training to their own needs and circumstances, while maintaining a high degree of FAA oversight. Finally, some attendees expressed concern that proposed rules not place United States aviation interests in the global economy in jeopardy against those of nations that have less restrictive rules and regulations in place.

Personal and Technological Countermeasures

Many innovative proposals were offered during the session. For example, one attendee suggested that airlines and flightcrews work together to obtain "circadian friendly" hotel rooms in which quiet corridors would be maintained, blackout curtains hung in the rooms, and other measures implemented to enhance rest during those periods when most people are active. An additional proposal called for using FOQA (flight operations quality assurance) data to match pilot performance against flight schedule and other data that have been associated with fatigue. Also, expert systems could be used that, with existing data on sleep, help pilots bid schedules, and airlines employ pilot bids, that could minimize the emergence of fatigue during subsequent flight operations. Similarly, a proposal was offered to employ automatic devices in cockpits that would alert crewmembers or require crewmember responses during a flight, to assure that pilots would remain alert during a long flight.

Education and Training

Attendees suggested that education for all personnel was critical to the effectiveness of countermeasures. Further, the group believed that successful countermeasures against fatigue require the active participation of all corporate levels, execute/managerial as well as those directly involved in flight operations. Attendees expressed the view that, following the conclusion of the conferences, the NTSB and NASA inform airline executives directly of the results of the Symposium to help obtain their cooperation in reducing the effects of fatigue at their airline. In addition, basic guidelines should be provided to airlines to assist their management in implementing fatigue countermeasures program at their airline.

Some attendees, representing general aviation interests, also raised the issue of educating general aviation pilots and corporate aviation departments in the need for effective fatigue countermeasures.

SUMMARY VIEWGRAPH

Scheduling

- Upgrade Flight/Duty/Rest (F/D/R) rules
- Regulate, not negotiate, F/D/R rules
- Apply science to F/D/R rules
- Finalize rule on F/D/R
- Avoid rigidity in F/D/R rules
- Level the F/D/R playing field world wide

Countermeasures

- Sleeping quarters at duty site and "circadian-friendly" hotel rooms
- Correlate flight data recorder readouts with crew fatigue factors
- Expert systems to help managers design crew schedules and help pilots bid schedules
- Educate top managers
- Cockpit crew alertness monitoring devices

Education

- Educate personal countermeasures, and educate the family
- Big and small airlines need basic guidelines
- Top-level buy-in is essential
- Integrate personal and company countermeasures
- Don't forget general aviation

THE AVIATION WORKING GROUP #2

Moderator Mr. Jim Danaher, National Transportation Safety Board
Analyst Dr. Malcolm Brenner, National Transportation Safety Board

Technical Representatives
Mr. Bob Benzon, National Transportation Safety Board
Mr. Ronald Simmons, Federal Aviation Administration

Hours of Service and Scheduling

The Aviation Group 2 felt that government regulation of flight and duty time standards was the starting point and foundation for all activities at controlling fatigue in operations. These regulations set the minimum standards for operations beyond which personal and company countermeasures can be applied. The group felt that it was important that the regulations provided core guidelines but also captured important differences in the industry, especially, for example, by providing special provisions applicable to overnight operations. The group felt that "rest" should be defined more operationally than the present definition as the number of hours off-duty. That is, "off duty" time rarely equals "rest" time. It is necessary to allow time for commuting, personal hygiene, and sustenance. Fatigue issues should be addressed more actively in accident and incident reports by the NTSB and the FAA. Fatigue should be assumed to be present until the investigation can rule it out.

Personal and Technological Countermeasures

The group felt that technology was a support, but not a substitute for personal management. Industry and individuals both have responsibilities for minimizing fatigue in operations. Industry can help by developing procedures so pilots can report themselves "too fatigued" to work without punishment, and by providing rest accommodations for quality sleep without noise interruptions. Employees can help by arriving at work rested, arranging their commutes from home and activities during the off-duty time so they are properly rested. When technology is developed, it should not be used to erode other existing or future fatigue countermeasures based on scheduling or personal management.

Education and Training

The group felt that there should be a clearing house to collect and make available successful training materials on fatigue developed by different transportation modes, different disciplines, and different nations. Education is the

most basic countermeasure for fatigue. It should be provided to managers, schedulers, and the general public to change attitudes and recognize the importance of fatigue. Pocket checklists, and checklists integrated into normal operations should address fatigue issues in heightening awareness of the fatigue-producing aspects of duty periods and in judging personal fitness for flight. ASRS reporting forms should enhance their reporting of fatigue, and NTSB/FAA investigations should enhance their monitoring of fatigue issues. Fatigue should be examined on the part of pilots, air traffic controllers, mechanics, and all other personnel in the operational system.

SUMMARY VIEWGRAPH

Scheduling

- Overnight flying – special regulations
- Address fatigue in mishaps
- Government regulation essential
- Define "rest" more operationally

Countermeasures

- Technology supportive of personal management
- Industry support of individual management and decisionmaking – industry support systems and "too fatigued"
- De-link technology and punitive actions
- Balance between industry/individual responsibility – commutes, rest accommodations, and rest periods

Education

- Intermodal, international, interdisciplinary training clearinghouse
- Mangers, schedulers, and the public need education
- Fatigue-related work schedule guidelines
- Enhance ASRS, NTSB, and FAA monitoring of fatigue

THE RAIL WORKING GROUP

Moderator Mr. Bruce A. Magladry, National Transportation Safety Board
Analyst Mr. David Mayer, National Transportation Safety Board
Technical Representatives
Mr. Robert Lauby, National Transportation Safety Board
Mr. Garold Thomas, Federal Railroad Administration

Hours of Service and Scheduling

The lack of schedule predictability and regularity were identified by the group as the number one fatigue producing problems for both train crews and management. For, without timely, accurate schedule information, railroad employees cannot effectively manage their off-duty time to minimize fatigue. The scheduling difficulties that give rise to unpredictability and irregularity are derived from several interrelated, but often conflicting demands that the railroads themselves cannot fully control. Factors that impact scheduling include: equipment breakdowns, emergencies, and power failures, imbalances in the direction of traffic flow, and the demands of customers who have increasing moved to just-in-time pick-up and delivery. Pool dispatch, extra board scheduling, and deadheading of crews also contribute to the problem.

Exacerbating scheduling difficulties is the Hours of Service (HOS) Act developed in 1907. It was not based on science and does not necessarily permit sufficient continuous sleep periods nor does it incorporate modern knowledge of circadian rhythms. Historically, it has also promoted an adversarial relationship between labor and management. The group felt it no longer works well. In a spirit of cooperation, government, management and labor should seek innovative and flexible schedule solutions and HOS reforms through pilot projects. However, as a basic tenet of railroad operations, the HOS should not be changed without a firm scientific basis and careful review by all the affected parties.

Personal and Technological Countermeasures

Currently employed fatigue countermeasures are not adequate. Alerters, for example, can be complied with while an employee is severely fatigued. Some existing crew quarters, intended to facilitate rest away from home, are not adequate for daytime sleeping because of noise or lighting or even maid service. Another countermeasure, albeit an unauthorized one, napping, can actually bring on disciplinary action. Nevertheless, there are times when it could be safely and effectively used to reduce fatigue and improve alertness. The group felt appropriate napping should be legitimized.

Group members felt some conditions and procedures seemed to induce fatigue, like poor locomotive cab environments and boring tasks. It was suggested crew input could improve both cab and task design. It was also suggested that various communications equipment and methods should be explored to give employees the

most up to date and valid line-up information so that they plan their sleep accordingly in order to report to work well rested. However, when significant line-up changes occur and an employee is called to duty early without having slept, there should be a mechanism to allow him to mark off without penalty. To do otherwise, may force a fatigued employee to work and create a danger to himself, his railroad and the public.

Fitness for duty testing was also addressed. It was felt that current tests are not yet valid and reliable, and that they miss the point anyway. Efforts should be directed toward developing schedules and working conditions that prevent fatigued employees rather than keeping the current conditions in place and trying to detect fatigued employees. Finally, responsibility for developing and promoting effective countermeasures was believed to belong to all affected parties.

Education and Training

Addressing fatigue through education and training was deemed essential and was considered a win-win proposition for labor and management, improving safety and productivity for each. The group felt that employees should receive training about sleep, sleep disorders, sleep strategies, and fatigue countermeasures. Both labor and management employees should receive the training in order to provide a common understanding of the issue. The training should be based on science with practical solutions, but should not ignore the important components of personal responsibility and behavioral change. Follow-up and feedback were also considered essential to determine efficacy and to reinvigorate individual efforts.

Several railroads already have fatigue education programs in place. The group acknowledged the value of such programs if they do not stand alone. They should be part of a multifaceted approach designed to manage fatigue and promote alertness. Training must accompany other efforts from labor and management to alter operations to facilitate individual employee actions to alleviate fatigue. Thought should also be given for protection of the jobs of employees who come forward after recognizing they have a sleep disorder.

SUMMARY VIEWGRAPH

Scheduling

- Schedule predictability and regularity
- Hours of service flexibility; Minimize deadheading and overnights
- Hours of service provisions based on science and modern demands
- Railroads should conduct hours of service pilot projects
- Enhanced trust to promote innovative thinking

Countermeasures

What is needed:

- Crew quarters suited for sleep
- Crewmembers should be able to mark off when fatigued without penalty
- Tasks that minimize boredom

- Legitimize sensible crew napping
- Fitness for duty testing -- not yet valid or reliable and misses the point
- Improved cab design using input from locomotive crews

Education

- Addressing fatigue is a win-win situation
- Education and training is essential – not a stand alone component
- All labor and management should receive training
- Training must be based on science with practical solutions
- Follow-up and feedback are essential
- Job protection for those who seek treatment

THE HIGHWAY WORKING GROUP

Moderator Dr. Vern Ellingstad, National Transportation Safety Board
Analyst Ms. Elaine Weinstein, National Transportation Safety Board

Technical Representatives
Mr. Joe Osterman, National Transportation Safety Board
Mr. Ron Knipling, National Highway Traffic Safety Administration
Ms. Deborah Freund, Federal Highway Administration

Hours of Service and Scheduling

There is more than enough research today to begin to effect changes in the scheduling practices of the trucking industry. The hours-of-service regulations are 50 years old and need to be changed. They do not fit with the circadian clock. The trucking industry is behind other modes in making changes to the hours-of-service regulations and scheduling practices based upon current research knowledge. The industry can initiate changes separately from federal regulation. The changes cannot be done in a vaccuum and need to consider employee, shipper and customer needs. There is also a need to address the problem across the industry and consider the differences between large and small companies. Some of the implications for public policy include the shortage of parking and driver safety at rest stops.

The solutions include regulatory and performanced-based measures.

- Revise the hours-of-service regulations
- Increase the number of driver rest areas
- Consider large versus small companies
- Develop performance-based measures

Personal and Technological Countermeasures

Personal and technological countermeasures should be explored and implemented on parallel tracks. Technology includes fitness-for-duty and alerting methods. Fitness-for-duty technologies are about three years away; alerting method technologies are five-ten years away. Personal countermeasures include napping, education, and medical fitness. They can be implemented immediately.

New technologies must be cost effective, show a safety benefit, and maintain the current level of productiveness. There was some concern expressed that fitness-for-duty detection would give drivers a false sense of security and they would thus be more likely to drive drowsy. Consideration to inter-individual differences needs to be considered along with how the fitness-for-duty testing device would be used. Is it for the driver, the employer, or the regulator? There was agreement that there should be penalties for failing a fitness-for-duty test.

Education and Training

Society needs to undergo major attitudinal changes towards driving when fatigued, similar to that experienced with drunk driving. Some promising efforts have been made in the area of education, such as the Wake UP brochure developed by the AAA Foundation and the American Trucking Associations. There is a need to evaluate the effectiveness of these educational materials to determine if they actually change behavior.

Taining for management and drivers is not widespread. ATA Safety Management Council is developing a best practices manual to help educate drivers on how to prepare for work.

- Enforcement training is needed for inspectors and police officers.

SUMMARY VIEWGRAPH

Scheduling

- Revise hours of service regulations
- Increase driver rest areas
- Consider small vs. large companies
- Also performance based measures

Countermeasures

- Technology -- there is none -- it is five-ten years away
- Personal – napping, medical screening, adequate sleep

Education

- Major cultural change toward fatigue needed -- like drunk driving
- Promising efforts toward general education have been made
- Specific training for drivers and management have been less widespread
- Enforcement training is needed

THE MARINE WORKING GROUP

Moderator Dr. Gerald D. Weeks, National Transportation Safety Board
Analyst Dr. Meg Sweeney, National Transportation Safety Board
Technical Representatives
Ms. Marjorie Murtagh, National Transportation Safety Board
Mr. Alexander C. Landsburg, Maritime Administration
Dr. Marc B. Mandler, United States Coast Guard

The working group consisted of more than 80 representatives from various sectors of the maritime industry. Their affiliations reflected the breadth and diversity of the industry. Shoreside managers and shipboard personnel represented many shipping companies in the inland towing, coastwise, and oceangoing trades. Other attendees came from six maritime schools, seven pilots' associations, and a variety of government agencies.

The group's task was to discuss three topics on managing fatigue in the marine industry: Hours of Service & Scheduling, Personal & Technological Countermeasures, and Education & Training. Discussions of each topic addressed three questions concerning implementation: What is currently used, what is needed, and who is responsible? Highlights of the discussions follow.

Hours of Service and Scheduling

Most mariners stand two- or three-section watches when at sea and so they have multiple work periods in a day. The group felt that although the watch system satisfies current hours-of-service regulations, problems of sleep fragmentation and sleep deprivation can arise. The group noted that the potential for long-term fatigue must also be considered--crew members may sign contracts of 10-12 months duration when sailing on foreign flag vessels. Some members of the group observed that an important issue underlying fatigue is workload. In turn, workload is correlated with manning levels. The group felt that there is a need to conduct shipboard workload assessments before regulators consider changes to hours-of-service or to manning regulations. The group concluded that industry should take the lead, in coordination with the regulators, to initiate such workload assessments.

Personal and Technological Countermeasures

Several of the attendees reported that their companies had implemented a variety of fatigue countermeasures. The countermeasures do not have to be "hi tech" to be effective. Even little things like having decaffeinated coffee available near the end of the watch can facilitate sleep during the off-duty period. As another example, some companies had installed acoustic insulation in berthing spaces or relocated those spaces to provide a more restful sleeping environment. Other companies had delegated certain tasks to ratings so as to relieve the workload of the licensed officers. The group

determined that a continued effort was needed to promote both corporate and personal alertness management strategies. They felt that additional interdisciplinary meetings, similar to this Symposium, would be useful for exchanging ideas and experiences with successful fatigue countermeasures. The participants concluded that it is the industry's responsibility to take the initiative in this area.

Education and Training

Currently, there is only a modest amount of education being conducted on fatigue and fatigue countermeasures. The attendees agreed that more education was needed and several of the maritime educators in attendance reported that their institutions were developing courses or course modules on the physiological basis, consequences, and ways of managing fatigue. The group felt that the first and foremost need was to shift the mariners' cultural attitudes concerning fatigue--to dispel the "iron-man" myth that fatigue can be overcome by increased motivation and experience. The group concluded that the greatest likelihood of success for developing and disseminating education was to forge a partnership triangle among management, labor, and government.

SUMMARY VIEWGRAPH

Scheduling

- Duration of the tour
- Review manning
- Industry led initiatives

Countermeasures

- Some countermeasures are being used in the industry
- Continued effort
- Industry initiatives

Education

- Training and education is available
- Shift culture
- Partnership triangle

THE PIPELINE WORKING GROUP

Moderator Mr. Barry Sweedler, National Transportation Safety Board
Analyst Mr. Bill Gossard, National Transportation Safety Board

Technical Representatives
Mr. Bob Chipkevich, National Transportation Safety Board
Ms. Linda Daugherty, Research & Special Projects Administration

Three distinct topical areas were discussed at the Fatigue Symposium addressing fatigue in the pipeline industry: hours of service and scheduling; personal and technological countermeasures; and education. A summary of the pipeline group discussion follows.

Hours of Service and Scheduling

In the area of hours of service and scheduling, it was determined that there currently are neither Federal or State standards nor are there any industry guidelines or recommended practices. Therefore, there are great differences in scheduling from company to company. Some general observations were that many employees in the industry rely on unscheduled overtime; in many companies employees have significant input into the schedules that they work; and that most schedules are rotating with 12 hour shifts. Most employees have little idea of the effects of fatigue and there is very little technical information available specific to the pipeline industry.

It was the group's conclusion that there is a definite need for information and guidance on fatigue/alertness issues. It also was concluded that there is a need for all levels (senior management, supervisors and employees) to learn about fatigue concerns. It was noted that there are industry associations such as the American Gas Association, American Petroleum Institute, the Institute of Gas Technology, and others that could address fatigue concerns and proper interventions in the area of hours of service and scheduling for the industries.

Personal and Technological Countermeasures

Presently, fatigue has not been considered as a problem by much of this industry, therefore, there has been little focus on personal or technological countermeasures. However, the industry does use a number of interventions that have been successful in mitigating some fatigue concerns such as; 2-hour call-ins to remote locations, deadman alarms, video cameras, bright lights and temperature control in control rooms. These interventions were not developed specific to fatigue concerns. The participants agreed that a "napping strategy" could possibly be a useful countermeasure, however, considerable education and understanding by senior management and supervisors of this fatigue countermeasure would be necessary.

There are no fitness for duty countermeasures in this industry with the exception of the liquified natural gas industry where Federal standards require a self-reporting system that the person leaving a shift must state that the person coming on duty is fit to work. The participants concluded that personal countermeasures could be addressed by company employee assistance programs.

Eduation and Training

Education on fatigue issues is scant. There is some abstract concern about fatigue by senior management and supervisors, however, that concern is not necessarily directed to operational concerns. In other words, most concern over fatigue involves emergency response conditions not day-to-day operations and shift work. The participants agreed that educational programs for senior management, supervisors and employees on fatigue/alertness issues could be conducted for employees first through company employee assistance programs and then to families, if employees saw the merit. It also was agreed that if fatigue countermeasures were marketed as a performance enhancement tool, perhaps senior management would support fatigue safety improvements such as scheduling strategies. The participants indicated there is a need for data on the relationship of fatigue and productivity in order to sell this initiative as an opportunity to top management. There was interest in tailoring the NASA/ Ames program on fatigue to make it more specific to the pipeline industry.

SUMMARY VIEWGRAPH

Scheduling

- Employee reliance on unscheduled overtime
- Employees have significant input into schedules
- All schedules are rotating
- Currently there are no guidelines
- Need information and guidance on fatigue
- Need for more awareness by all

Countermeasures

- Use techniques for monitoring
- Bright lights and temperature control- these techniques are not specific to fatigue
- Napping strategy may work with education
- No fitness for duty countermeasures
- EAP address seminar on fatigue

Education

- Abstract concern about fatigue
- Some knowledge not very detailed

- Need for programs on expectations and fatigue
- Performance enhancement tool – scheduling strategy
- Data relationship fatigue-productivity
- Work smart - Play smart